first catalogue of the kind was that of Lesquereux, published more than twenty years ago, and containing 706 species. The present catalogue testifies to the fact that since that time species have been described with great industry. Although no statement is given as to the number of species, it is remarked that the Potomac flora alone now numbers more than the total Cretaceous and Tertiary floras known to Lesquereux. The catalogue is a real bibliography and must prove of great service.—J. M. C.

NOTES FOR STUDENTS.

H. H. DIXON has turned his attention to transpiration, and in Proc. Roy. Irish Soc. III. 4 : 618–635. 1898 discusses the effects of stimulative and anæsthetic gases on transpiration, and transpiration into a saturated atmosphere. —C. R. B.

CZAPEK points out[19] an interesting case of adaptation in leaves of *Cirsium eriophorum*. Plants growing in very sunny situations on the southerly mountain slopes in central Bohemia had the segments of their pinnatifid leaves erected into two comb-like rows, while in shady places these are transverse. The erect segments of the sun-beaten leaves were inrolled at the edges and were different in structure from the shade leaves, having palisade cells 25 per cent. longer, and richer in chlorophyll. The same difference was remarked between the erect segments and transverse portions of the same leaf.—C. R. B.

THE CYTOLOGY of the yeast cell has been a difficult matter to investigate, but important results have been obtained by Janssens and Leblanc.[20] They used malachite green, dahlia, gentian violet, Delafield's hæmatoxylin, and "black hæmatoxylin" (black hæmatoxylin differs from Delafield's in that the ammonia alum of the latter is replaced by iron alum). These stains show that every yeast cell contains a nucleus and a nucleolus. During budding there is indirect division of the nucleus in some species, while in the common *Saccharomyces cerevisiæ* and some others the division is direct. Cells about to produce spores contain two nuclei which fuse. The resulting spore on germination shows a much modified form of division. The paper is illustrated by excellent plates.—CHAS. J. CHAMBERLAIN.

UNDER THE TITLE *Analecta bryographica Antillarum* Dr. Karl Müller-Halle has published[21] a long list of mosses from the Greater and Lesser

[19] Œsterr. bot. Zeit. 48 : 369–371. 1898.

[20] JANSSENS, FR. A. and LEBLANC, A.—Recherches cytologiques sur la cellule de levure. La Cellule 14 : 203–343. 1898.

[21] Hedwigia 37 : (2–?) 266. 1898.

Antilles, a publication which has special interest in view of the botanical collections now being made in Cuba and Porto Rico. These "crumbs" Müller has swept up from various collections, some as old as Charles Wright's (1856). He enumerates 175 species, of which almost 100 are marked *n. sp.* Of these, however, nearly one-fourth have been previously otherwise determined by such bryologists as Sullivant, Mitten, and Bescherelle. In view of these ratios we are inclined to think the finding of so many "crumbs" is due rather to the fineness of the crumb brush than to the carelessness of other sweepers.—C. R. B.

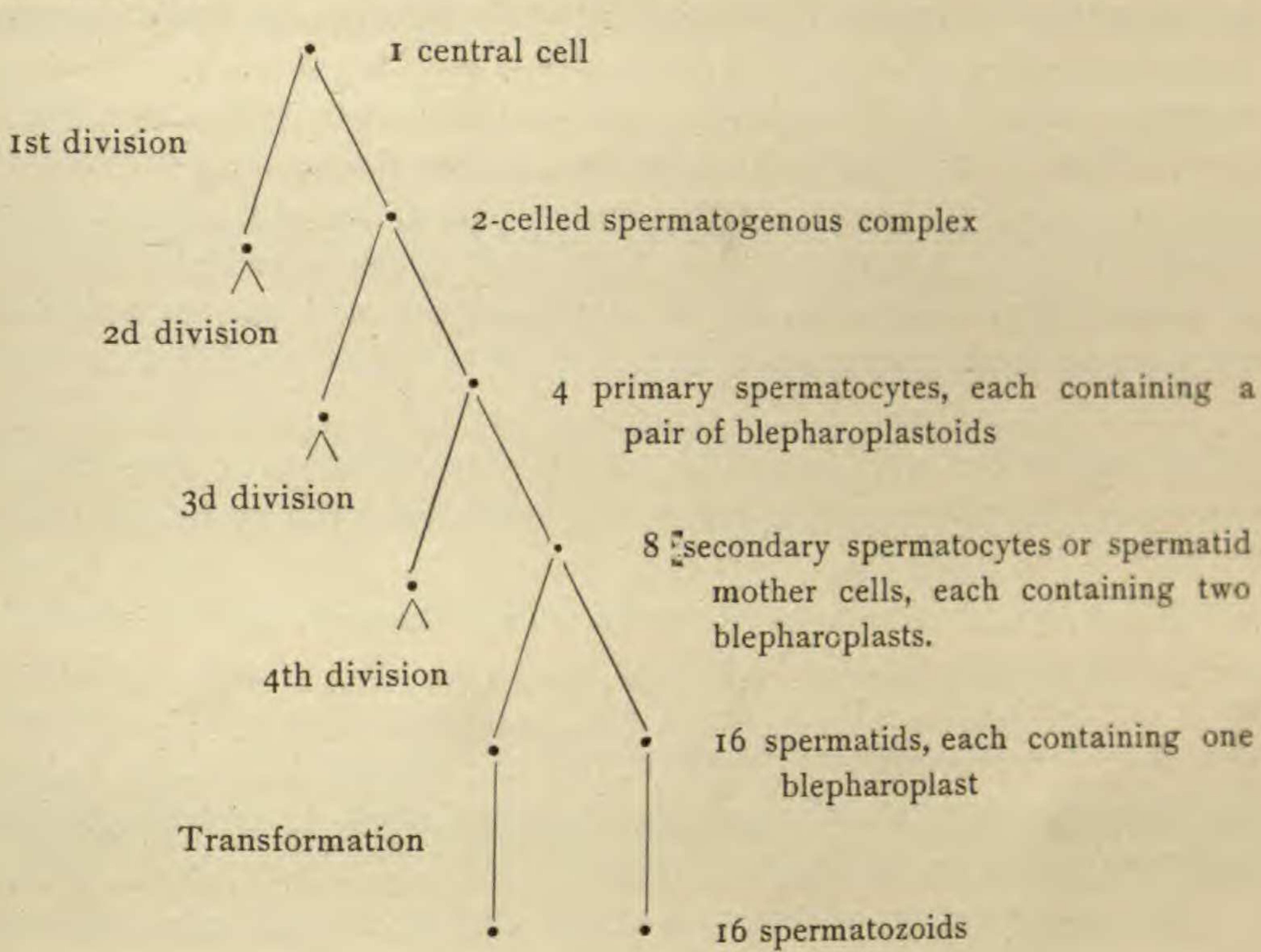
BELAJEFF'S account[22] of the origin of the cilia of spermatozoids has been confirmed and supplemented by Dr. W. R. Shaw,[23] who has taken Onoclea and Marsilea as his types. In these plants, as in Equisetum and Gymnogramme, the cilia arise from a small cytoplasmic body lying in the mother cell of the spermatozoid. For this cytoplasmic body, which was designated "Nebenkern" by Belajeff, Dr. Shaw proposes to adopt the more expressive name "blepharoplast," a name first employed by Webber to denote a similar structure in Zamia. Dr. Shaw has sought to discover the origin of the blepharoplasts and their behavior in karyokinesis. In the antheridia of Marsilea true blepharoplasts are found only in the last two cell generations. In the early stages nothing like a blepharoplast is present, but in the karyokinesis intervening between the two- and four-celled stage a small body appears at each pole of the two spindles; subsequently each of them divides into two. Since these bodies disappear into the cytoplasm and do not give rise directly to the true blepharoplasts, the author calls them "blepharoplastoids." About the time when the blepharoplastoids are lost sight of, the blepharoplasts make their first appearance as small granules situated in the spindle-poles of the nuclear figures which precede the eight-celled stage of the antheridium. Each of them divides into two. During the following resting condition of the nucleus these two halves gradually separate, at the same time increasing in size, and move round to the positions to be taken by the poles of the next following spindles. During the ensuing karyokinesis they remain practically unchanged. In the mother cell of the spermatozoid the blepharoplasts become granular, elongate, and probably undergo the same transformations which Belajeff has described in detail.

The accompanying diagram, copied from Dr. Shaw's paper, will help to make clear the relations of the blepharoplast as, well as to explain his substitution of the zoological terms "spermatocyte" and "spermatid" for the exceedingly cumbrous phraseology in use among botanists. While changes in terminology are difficult to secure, the advantages of the suggested modifications are obvious. Indeed it would be almost ludicrous to speak of "great-

[22] Berichte der deutschen bot. Gesell. **15**: 337–345. 1897, and **16**: 140–143. 1898.

[23] Berichte der deutschen bot. Gesell. **16**: 177–184. 1898.

grandmother cells," as would be necessary in describing the primary spermatocytes.



Naturally the question arises: Is there any relationship between blepharoplasts and centrosomes? The identity of the two structures was conjectured by Belajeff and is accepted by Ikeno; and certainly when one considers their similarity in staining reaction, position, size, and divisions, together with the analogies which animal spermatogenesis affords, it seems a not unreasonable conjecture to suppose the blepharoplast to be a centrosome modified for the performance of a new function. Such a view will probably be taken by those who share the opinions of Guignard and Schaffner, and by most animal cytologists. But those who hold with Strasburger and his assistants that there are no centrosomes among cormophytes will of course reject it. Neither Belajeff nor Shaw is prepared at present to maintain the homology of centrosome and blepharoplast. Dr. Shaw says: "At present we can only express the view that the blepharoplast is a kinoplasmic body set apart for the purpose of forming cilia."—WILSON R. SMITH.

SINCE THE ANNOUNCEMENT by Treub in 1891 of chalazogamy in Casuarina there has been on the part of morphologists a persistent interest in knowing just how far this process extends in fact and in meaning. It was for a time supposed that the phenomenon is shown by Casuarina only, and this was used as the basis of a new classification—the chalazogams represented by Casuarina, and the porogams represented by all other angiosperms. But such ideas had to be abandoned when Miss Margaret Benson reported chalazogamy in Alnus, Corylus, Betula, and Carpinus. Later, Nawaschin announced that in *Juglans regia* the pollen tube takes an intercellular course within the ovule and agrees in a general way with the first reports of chalazogamy. Since Miss Benson's publication it was supposed that this peculiar condition was confined to the Casuarinaceæ, Betulaceæ, and Juglandaceæ, until, in Nawaschin's laboratory, the genera Urtica, Cannabis, Humulus, and Morus were found to have the pollen tube evading the micropyle and taking an intercellular course within the ovule, though not agreeing in details with the previous accounts of chalazogamy.

New evidence is now furnished by Nawaschin,[24] the plants studied being *Ulmus pedunculata* and *U. montana*. The writer indulges in a discussion of the nature and location of the influence which directs the growth of the pollen tube of the porogams. This influence may be entirely within the tube; or within a secretion produced by certain cells of the style and nucellus which attract and nourish the tube; or these cells of the style and nucellus may serve only as mechanical guides, while the real impulse to growth rests within the tube. It is now probable, however, that a combination of all these factors constitutes the directing influence. Such might furnish an explanation for the porogams but not for the chalazogams.

The behavior of the pollen tube of the elms is divided into three categories. The first is given as the normal behavior, in which the pollen tube passes down the funiculus of the anatropous ovule, which is suspended from the top of the carpel cavity. From the funiculus the tube passes across above the short outer integument and through the inner one, reaching the top of the nucellus, after which the regular behavior is observed. In the second category the tube may branch profusely and with no definiteness within the funiculus and the integument. This branching may occur out of the tissues after the pollen tube has reached the tip of the nucellus. In such cases the male cells within the tube always follow the newest branch. In the third category the tube grows down the funiculus near to the bases of the integuments, then grows up through the inner integument to a region on a level with the nucellus tip, when it turns across to the bottom of the micropyle as before. Or, instead of passing up between the cells of the inner integument, it may pass through the chalaza into the embryo sac as the tube of a true chalazogam.

In no case was any tissue found which could be considered especially conductive or nutritive tissue. Nawaschin thinks these two species represent a region in which these tissues are not yet definitely differentiated, but that the chalazogamic habit is being dropped as is evidenced by the varied attempts of the pollen tube to reach the tip of the nucellus, and by occasional reversion

[24] NAWASCHIN, SERGIUS: Ueber das Verhalten des Pollenschlauches bei der Ulme. Bull. d. l'Acad. Imper. d. Sci. d. St. Petersbourg 8: 345. 1898.

to passage through the chalaza. He would look upon the elms as one of the transition types from the chalazogams to the porogams.

Supplementing this work of Nawaschin, N. Zinger has found[25] that in the ovules of Cannabineæ the inner integument, which is elsewhere very delicate, over the apex of the nucellus becomes massive and is completely coalescent with the thick outer integument. The micropylar canal before fertilization is entirely closed by papillary outgrowths from the surface and marginal cells of the integuments. These outgrowths form a densely interwoven firm tissue above the apex of the nucellus, passing into the tissue of the ovary wall above. The pollen tube follows the central cells of the styles (conducting tissue ?) downwards, passes along the upper wall of the ovary, penetrates the outer and inner integuments or bores through the tissue filling the micropyle, and reaches finally the nucellus. Here it produces numerous sac-like tumid branches about the apex, until one very delicate tube penetrates to the embryo-sac.—OTIS W. CALDWELL.

A RECENT MONOGRAPHIC work by Adamovic on the vegetation formations of eastern Servia adds greatly to our knowledge of the flora of that country.[26] Botanical research in Servia is a matter of the last two decades, because of the blighting rule of the Turkish government. The names of Pancic and Petrovic are about the only ones that need to be recollected, with the exception of that of the author of the monograph under review.

Servia is a mountainous country in the truest sense, even the river valleys being some hundreds of meters above sea level. The mountains belong to the Balkan and Rhodope systems and are of various geological ages from Precambrian to Recent. The country is drained by the Morava and Timok rivers, tributaries of the Danube. The climate is intermediate between that of continental Europe and the Mediterranean climate to the south.

The author first discusses the formations of the plains and lower hills. There are extensive rocky pastures, mostly along the slopes of hills; the floral covering is sparse and the plants are decidedly xerophilous in structure and periodic in their life functions. These rocky pastures grade into hilly steppes, where the soil is more gravelly or sandy than rocky. In both of these formations euphorbias are characteristic. The meadows are divided into valley or true meadows and swampy meadows, the latter grading into swamps. Rock formations are quite abundant and closely related to rocky pastures, though the rocks are larger and the vegetation more open. The northern slopes have a richer flora because of greater moisture. The swamp and water formations do not form a very large part of the flora of the country. Among the shrub and tree formations there are extensive areas of brushwood;

[25] Flora 85: 189–253. 1898.

[26] ADAMOVIC, LUJO.—Die Vegetationsformationen Ostserbiens. Engler's Bot. Jahrb. 26: 124–218. 1898.

along streams are thickets with a dominance of willows; the only formations with tall trees are the poplar forests. The influence of man on the flora of the plains and hills has been very great, especially in the destruction of forests.

On the mountains below the timber line mountain meadows are found quite commonly. In the calcareous regions there are peculiar funnel-shaped depressions formed by the erosion of the limestone. These depressions are called *Dolinen*, and their flora is more or less xerophytic. The rock formations of course are well developed, and the author divides them into calcareous and eugeogenous, the latter with a much richer plant covering. (The term eugeogenous was introduced years ago by Thurmann; it means easily decomposed into good soil.) There are low forest thickets (*Buschwald*) in very many places, representing a second growth. There are two true forest types, the oak forests and the subalpine forests with a dominance of beeches.

Above the timber line there are subalpine meadows, heaths and thickets. Higher up are alpine mats and extensive lithophytic formations. The influence of man becomes less and less evident as the altitude increases. The last chapter gives a short summary of the most important results. Adamovic subdivides eastern Servia into four altitudinous regions based on barometric measurements. (1) The regions of plains and hills reaches up to 600^m, and is characterized by the almost entire absence of forests, a condition wholly due to the influence of man. The areas once wooded are occupied by culture plants, mainly cereals, hemp, tobacco, and melons. The hillsides are covered by vineyards and fruit trees. The vegetation belongs to Drude's Pontic type, mixed with some Mediterranean elements. The average annual temperature is 11.5°C., and the vegetation period is ten months. (2) The mountain region extends from 600^m up to 1100^m. Culture formations are much less abundant, the Mediterranean floral elements have disappeared, the Pontic elements are less abundant, and the characteristic vegetation of central Europe is preeminent. The low second growth timber is the most common formation. The mean temperature is 9.5°C. and the vegetation period nine months. (3) The subalpine region extends between 1100^m and 1660^m. The beech forests have replaced the oak and the second growth. The heaths and subalpine meadows are also prominent. The floral elements coincide mainly with the mountain zone of central Europe. The average temperature is from 7° to 8°C. and the growing period less than eight months. (4) The alpine region has no culture formations and the dominant landscape features are given by rocks and the variegated alpine mats. The floral elements are a mixture of the alpine types of central Europe and endemic types. The mean temperature is about 6°C. and the vegetation period scarcely six months.—HENRY C. COWLES.

M. CH. DASSONVILLE has made an elaborate study of the effect of mineral salts upon plant structure.[27] A great number of experiments were made, in which direct control was had by germinating in solutions, while supplementary evidence was gained by germination in soil to which either solutions of a single salt of graded strengths were presented, or complex solutions accompanied by check experiments in which the salt under study was omitted from the complex solution presented. Check experiments in distilled water accompanied those in which germination was effected in a liquid solution. Certain mineral solutions induced more vigorous growth of both vegetative and floral parts, but a period of life no longer than in aqua pura. M. Dassonville presents also the surprising results that cutinization, sclerification, and lignification are much more accentuated in young plants in distilled water than those of the same age in mineral solutions. The observations are not directed so much to general effects as to the most intimate histological alterations. One comprehends that the work must be most extensive to present reliable results.

The effect of particular salts may be summarized as follows: magnesium sulfate retards normal development only at first, later becoming indispensable for it. In the castor-oil plant the retarding effect is chiefly upon the terminal root, which is atrophied. Later adventitious roots develop, the more the stronger the solution. In hemp there is no adventitious development, but the secondary wood is stimulated and the primary vessels retarded.

Potassium phosphate is necessary at all stages. Its absence insured a characteristic abnormal development of the roots. Its presence stimulates the sclerification of the pericycle.

Potassium silicate deepens the green of the leaves and affects their structure and lignifies the peripheral cells of the root tip.

The effect of nitrates varies in different plants, and with the strength of the solution and the stage of development. No attempt was made to formulate a general law from the confusing results of the seven types studied. However, the acetates of ammonia and potassium seem best for hemp and buckwheat, while sodium acetate is deleterious. No matter what the base, the acetates call forth a special tint in the leaves, which the author attributes especially to acetic acid.

Potassium stimulates growth, but retards the differentiation of sclerenchyma, and may thus increase the liability of "lodging" in the Gramineæ. Sodium is less favorable to growth, but hastens lignification of the stem-base, preventing "lodging."

Calcium chloride and magnesium seem equally beneficent to hemp and buckwheat, and the decreasing order of utility of acids for these types is acetic, phosphoric, hydrochloric.

[27] Influence des sels minéraux sur la forme et la structure des végétaux. Revue générale de Botanique 10: 15 sqq. 1898.

The author argues that the absence of high nutrition, *i. e.*, germination in distilled water, induces the seedling to direct its energy chiefly to cell differentiation. And, vice versa, it is to be expected, and his results demonstrate, that a seedling grown in a rich nutrient medium, such as Knop's solution, will multiply cells rapidly without differentiation. In other words, sterile soil predicates precocious sclerification ; rich soil a later appearance of the ultimate structure, but a more rapid division of cells without differentiation. Apparent counter evidence is offered by the effect of single salts, which stimulate the differentiation of particular regions, as the effect of potassium phosphate on the pericycle or of magnesium sulfate on the vessels of the root. M. Dassonville evades a contradiction of results, asserting the latter to be a differentiation of a particular region called upon to play a definite rôle by the abundance of particular substance, and holding that, for the rest, the meristem reserves as long as possible the expenditure of energy in the way of differentiation. The author seriously questions the taxonomic value of anatomical characters, a challenge which, with the trend wholly in the direction of phylogenetic characters as the ultimate basis of classification, will find few takers. Such specific distinctions are altogether too cumbrous for taxonomic purposes.

The value of these results is apparent and we recognize the great difficulties surmounted in their attainment. The deductions, however, are by no means final, because there is too little accord among even the few types studied. Results obtained from the investigation of lupine, wheat, oats, morning glory, egg plant, tomato, and pine, do not permit the induction of general laws. Though the methods show the work to have been stupendous, we are impressed with the impossibility of eliminating disturbing factors aside from the one under consideration. For example, the author concludes that the optimum of potassium phosphate "augments only the quantity of water in the plant," a result obtained from buckwheat. But, he adds, "sometimes the amount of dry matter is increased. It is so in hemp."—JOHN GAYLORD COULTER.